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LOCTITE®

Shaft Repair Service Manual

Henkel Excellence is our Passion

Introduction

THIS PRODUCT GUIDE has been designed to provide quick and easy assistance to the professionals responsible for the maintenance and repair of shaft assemblies. With the help of this guide, you can:

- Easily select the right way to repair a variety of shaft assemblies
- Pinpoint the most suitable repair method for worn parts, or prevent wear proactively
- Determine the best Loctite® product for your particular maintenance or repair problem

Most shaft assemblies are incorporated into systems carrying a significant capital equipment value. It is therefore vital to maximize their useful lives and ensure reliable performance. Proactive maintenance can reduce down-time, enhance reliability and dramatically cut costs.

There is a comprehensive range of LOCTITE® PRODUCTS to:

- Repair and prevent common failures to extend end-product life and minimize downtime
- Reclaim worn or damaged assemblies to avoid scrap and replacement costs
- Assist in assembly, installation and disassembly
- Help ensure reliability and smooth running by restoring performance to “as new” condition

Profit from RELIABILITY

At Henkel, we understand the problems you face in ensuring reliability, safety and durability. We provide a wide range of industry-leading products for cost-efficient, easy and effective shaft maintenance and repair. When equipment fails, the greatest concern is getting it running again. Loctite® products not only provide reliable on-site repair capability, but emergency repair and service solutions that last or even extend the lifetime of your equipment.

Our focus on increasing reliability, through the protection of our customers’ equipment, facilities and people, delivers maximum value to the maintenance process.

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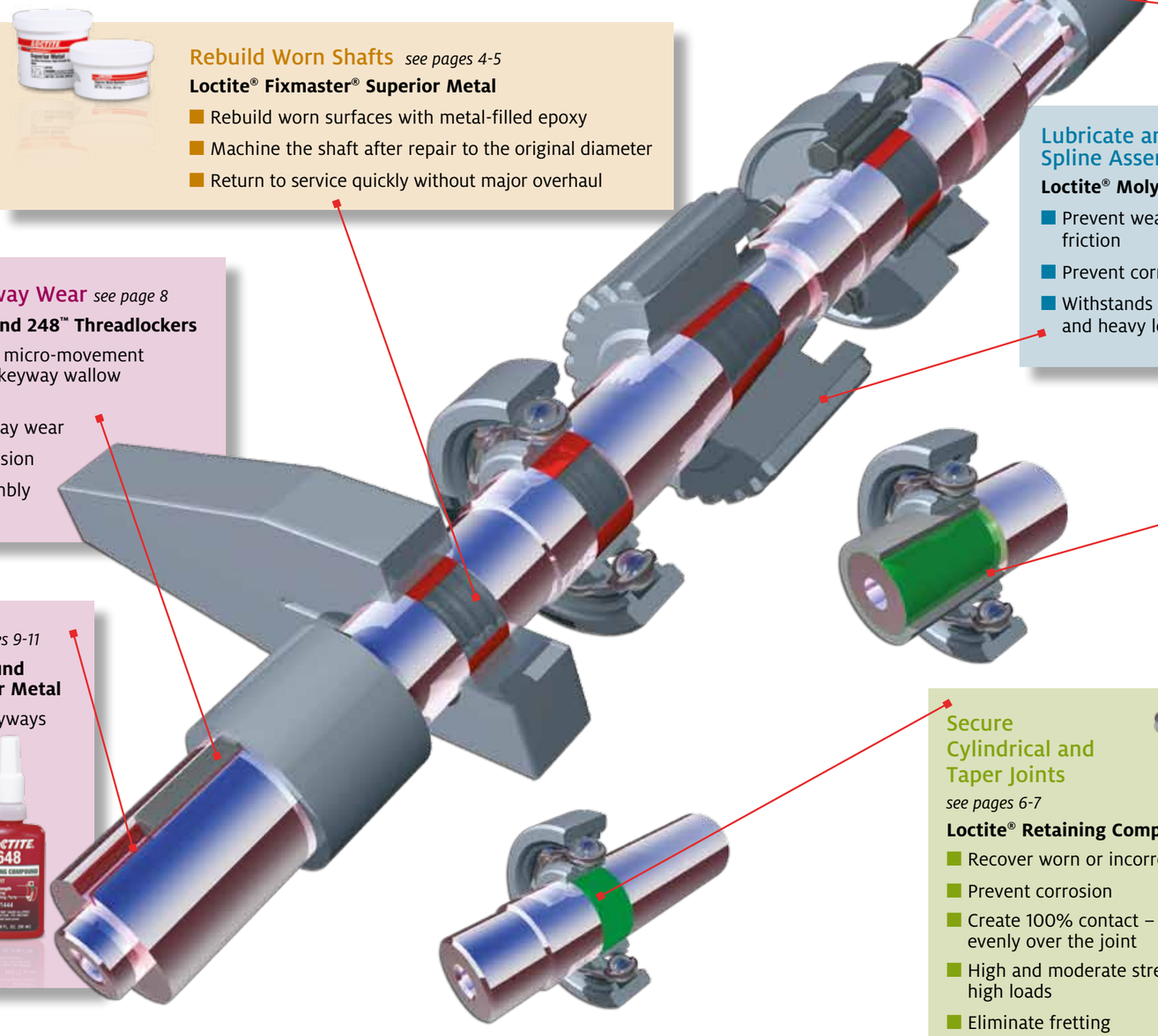
To speak with our technical service department or to contact your local Loctite® product specialist, call 1-800-LOCTITE (562-8483) or 1-800-263-5043 in Canada, or visit us online at www.loctite.com

Shaft Repair Product Application



Rebuild Worn Shafts *see pages 4-5*

Loctite® Fixmaster® Superior Metal

- Rebuild worn surfaces with metal-filled epoxy
- Machine the shaft after repair to the original diameter
- Return to service quickly without major overhaul

Prevent Keyway Wear *see page 8*

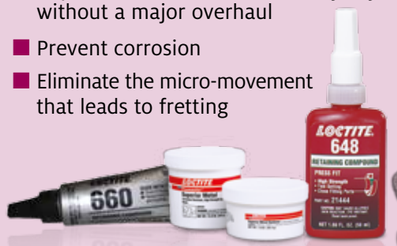
Loctite® 243™ and 248™ Threadlockers

- Eliminate the micro-movement that leads to keyway wallow and fretting
- Prevent keyway wear
- Prevent corrosion
- Ease disassembly

Repair Worn Keyways *see pages 9-11*

Loctite® 660™ Retaining Compound and Loctite® Fixmaster® Superior Metal

- Repair and restore wallowed keyways without a major overhaul
- Prevent corrosion
- Eliminate the micro-movement that leads to fretting



Lubricate and Protect Spline Assemblies *see pages 12-13*

Loctite® Moly Paste

- Prevent wear caused by friction
- Prevent corrosion
- Withstands extreme pressure and heavy loads

Secure Fixed Spline Assemblies

see pages 12-13

Loctite® 660™ Retaining Compound

- Eliminate micro-movement that leads to wear
- Prevent corrosion

Sleeving a Worn Shaft

see pages 4-5

Loctite® 648™ Retaining Compound

- For badly worn shafts
- High load applications

Secure Cylindrical and Taper Joints

see pages 6-7

Loctite® Retaining Compounds

- Recover worn or incorrectly machined components
- Prevent corrosion
- Create 100% contact – load and stress distributed evenly over the joint
- High and moderate strength products can carry high loads
- Eliminate fretting
- Prevent bearing spinout

Additional Loctite® Products:

Loctite® ODC-Free Cleaner & Degreaser

- Use with all repair methods for cleaning parts prior to adhesive bonding

Loctite® 7649™ Primer

- Use in combination with Loctite® Retaining Compounds
- Increase cure speed on passive surfaces such as stainless steel, aluminium and plated metals

CHALLENGE

Repairing a badly worn shaft

CAUSES:

- Out-of-tolerance machining results in loose components; this leads to micro-movement and wear
- Load produces axial forces that are higher than original calculations
- Insufficient interference or inappropriate loads lead to spun bearings
- Use of components in aggressive environments and at elevated operating temperatures

SOLUTION #1

Rebuilding the damaged shaft with Loctite® Fixmaster® Superior Metal

STEPS TO REPAIR:

1. Using a lathe, undercut the shaft in the worn area as follows: Shaft diameter: 13 mm to 25 mm; desired undercut: 1.5 mm. Shaft diameter: 25 mm to 75 mm; desired undercut: 3 mm.
2. Dovetail the ends of the worn area to anchor the application into place.
3. Finish undercutting by machining a rough cut surface (e.g., Rz := 100 µm). The larger the shaft diameter, the coarser the cut.
4. Clean parts with **Loctite® ODC Free Cleaner & Degreaser**.
5. Apply a very thin layer of **Loctite® Fixmaster® Superior Metal** and force it into the rough surface finish. Turn the shaft at a very low speed and continue to apply adhesive using a putty knife or similar tool. Build the surface above the final desired level.
6. Allow the adhesive to cure for 12 hours at room temperature. If necessary, apply dry heat to the repair area to speed the cure.
7. Machine the repair to the required dimensions.
8. Cut the material when the component is dry, using carbide or high speed steel. If polishing is required, use an abrasive paper.

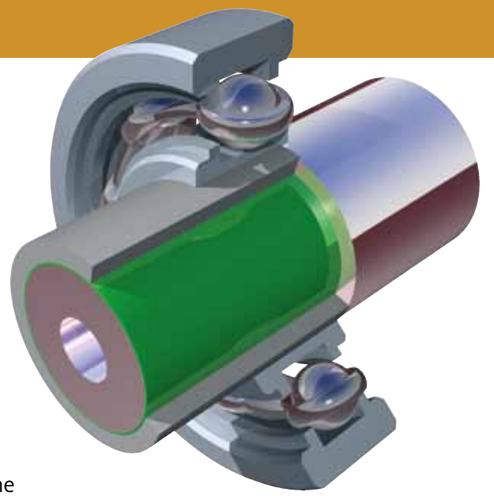
Note: *When mounting components to the rebuilt surface with Loctite® Retaining Compounds,* **Loctite® 7649™ Primer** *is required.*

RESULTS

- Prevent downtime and scrap costs by reparing worn shaft
- Epoxy solution uses standard machine tools, no special equipment or training required

SOLUTION #2

Sleeving Reliably with Loctite® Retaining Compounds



STEPS TO REPAIR:

1. Determine appropriate size of sleeve.
2. Create a transition fit joint between shaft and sleeve (for tapered joints, create a press fit).
3. Ensure the outside diameter is the specified shaft diameter (for a taper joint, the outside diameter should be the nominal diameter of the original cone).
4. Roughen the surface.
5. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
6. Apply a bead of **Loctite® 648™ Retaining Compound** to the circumference of the shaft at the leading edge of the component to be inserted. Apply the adhesive to both parts of the assembly. In the case of a shrink fit (using thermal energy for assembling), apply the adhesive onto the cold part, coating the complete engagement area.
7. Assemble sleeve; in some cases, heat should be applied to the fit.
8. Wipe off excess adhesive.
9. Allow adhesive to cure.
10. Follow the same procedure for press-fit joints between the sleeve and bearing.

RESULTS

- Repair worn shaft
- Unitize assembly, distributing load evenly
- Prevent downtime and scrap costs
- Protect new components against wear, abrasion and chemical attack

LOCTITE®

Securing Cylindrical and Taper Joints

CHALLENGE

Reliably secure components to shaft

CAUSES:

- Out-of-tolerance machining results in loose components, leading to micro-movement and wear
- Load produces axial forces that are higher than original calculations
- Insufficient interference or inappropriate loads lead to spun bearings
- Use of components in aggressive environments and at elevated operating temperatures

SOLUTION

Mount components to shaft using Loctite® Retaining Compounds

STEPS TO REPAIR:

First select the proper repair adhesive according to the extent of component wear or gap fill required:

Type of Fit	Loctite® Retaining Compound	Benefit	Maximum Repair Gap	Cure Time (Setup/Full Strength)
Press Fit	**Loctite® 648™**	High Strength/Rapid Cure	up to 0.005" (0.1 mm)	5 minutes/24 hours
	Loctite® 668™	Semisolid	up to 0.005" (0.1 mm)	30 minutes/24 hours
	Loctite® 609™	General Purpose	up to 0.005" (0.1 mm)	10 minutes/24 hours
Slip Fit	**Loctite® 620™**	High Temp	up to 0.015" (0.4 mm)	30 minutes/24 hours
	Loctite® 680™	High Strength	up to 0.015" (0.4 mm)	10 minutes/24 hours
Medium to Large Gaps	**Loctite® 660™**	Restore Worn Parts	up to 0.020" (0.5 mm)	20 minutes/24 hours

1. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
2. Roughen the shaft-mounted component and shaft with abrasive paper at the bonding area.
3. Re-clean parts.
4. Apply a bead of repair adhesive to circumference of the shaft at leading edge of the component. Apply adhesive to both parts of assembly. In the case of a shrink fit (using thermal energy for assembling), apply adhesive onto the cold part, coating the entire engagement area.
5. Assemble shaft-mounted component; in some cases, heat should be applied to the transition fit.
6. Wipe off excess and allow to cure.

RESULTS

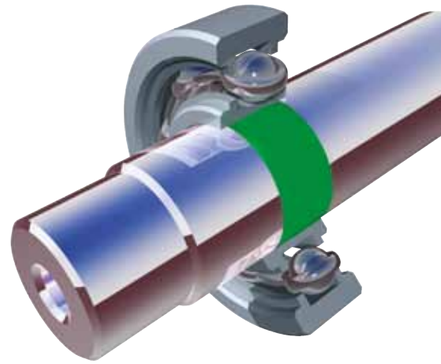
- Adhesive fills airspace – sealing from leaks, rust and corrosion
- Eliminates micro-movement between component and shaft
- Provides 100% contact, distributing loads and stress evenly

CHALLENGE

Prevent bearing spinout, corrosion and component damage

CAUSES:

- Bearings are prone to spinning either on their shafts or within their housings. This results in damage to these parts regardless of whether or not they are a press, shrink or slip fit
- The airspace that exists between a bearing and shaft is an area where rust can form and cause damage to the parts and can also be a leak path for fluids
- Airspace allows micro-movement leading to fretting and corrosion



SOLUTION

Retain joints using Loctite® 609™ General Purpose or Loctite® 648™ High Strength Retaining Compounds

STEPS TO REPAIR:

1. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
2. Apply a bead of **Loctite® Retaining Compound** to the circumference of the shaft at the leading area of the component.
3. Press the bearing onto the shaft using normal techniques.
4. Wipe off excess material.

QUESTIONS?

To speak with someone in our technical service department or to contact your local Loctite® product specialist, call 1-800-LOCTITE (562-8483) or 1-800-263-5043 in Canada.

RESULTS

- Reduces shaft and/or bearing housing damaged
- Fills airspace – sealing from leaks, rust and corrosion
- Eliminates micro-movement between bearing and shaft that could lead to fretting damage
- Provides 100% contact, distributing loads and stress evenly

Keyed Assemblies

CHALLENGE

Preventing keyway wear

CAUSE:

- In a new assembly the fit between the key and keyway is usually tight; however, over time, wear can cause this fit to loosen, leading to damage to the keyway

SOLUTION

Loctite® Medium Strength Threadlockers are appropriate for gap fill and will provide needed medium strength, while allowing easy removal for servicing.

STEPS TO REPAIR:

1. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser.**
2. Apply several drops of **Loctite® 243™ Threadlocker** into the keyway or apply **Loctite® 248™ Threadlocker Stick** to the key.
3. Insert the key into the keyway.
4. Wipe off excess adhesive.
5. Allow to cure before assembling the shaft-mounted component.

RESULTS

- Eliminates micro-movements that can lead to fretting
- Prevents keyway wear
- Prevents corrosion
- Eases disassembly

CHALLENGE

Repairing worn keyed assemblies

CAUSES:

- Alternating loads and combined loading results in micro-movement wear and loose parts
- Over time, wear can cause keys to loosen, leading to damage of the keyway
- Out-of-tolerance machining

SOLUTION #1

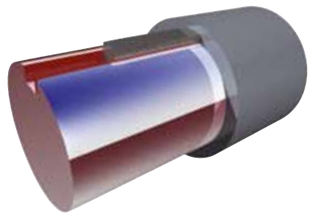
Loctite® 660™ Retaining Compound is a very thick product, allowing it to fill large gaps.

STEPS TO REPAIR:

1. Clean shaft, keyway and key stock with **Loctite® ODC-Free Cleaner & Degreaser.**
2. Apply **Loctite® 660™ Retaining Compound** into the worn keyway.
3. Insert the key into the keyway, wipe off excess and allow to cure.
4. Assemble component as usual.

SOLUTION #2

Repairing badly worn keyed assemblies by resizing the existing keyway



STEPS TO REPAIR:

1. Resize the worn keyway.
2. Select proper keystock to fit the new keyway.
3. Machine a step in the new key to fit the female component.
4. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
5. Apply **Loctite® 648™ Retaining Compound** to the keyway of the shaft (where there is a high power application, apply **Loctite® 648™** onto the whole shaft at the engagement area).
6. Assemble the key into the shaft.
7. Wipe off excess adhesive.
8. Allow product to cure.

RESULTS

- Restores assembly, so it is ready for service without a major overhaul
- Secures the key in the keyway
- Eliminates micro-movements that lead to fretting
- Prevents corrosion

SOLUTION #3

For badly worn keyway: fill in worn keyway and cut new keyway

If parts are very badly worn, it may be necessary to cut new keyways. In this situation the old keyways can be filled as described below.

STEPS TO REPAIR:

1. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
2. Apply **Loctite® Fixmaster® Superior Metal** into the keyway of both the shaft and collar. Fill all the available space. Allow to cure.
3. If a rounded surface is required, machine the repair to the original dimensions of the shaft and bore of the collar.
4. Machine a new keyway in the shaft and collar, opposite the original keyway.
5. Re-clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
6. Apply several drops of **Loctite® 243™ Threadlocker** directly into the new keyway and insert key.
7. Wipe off any excess adhesive.
8. Assemble the components.
9. Allow to cure.

CHALLENGE

Reliably securing fixed spline assemblies

CAUSES:

- Out-of-tolerance machining of components leads to micro-movement and wear
- Alternating loads
- Worst case combined loading
- Damage during assembly
- Incorrect assembly due to contamination of the parts
- Incorrectly specified spline drive – producing overload during operations

SOLUTION

Secure fixed spline assembly with Loctite® 660™ Retaining Compound

STEPS TO REPAIR:

1. Create a chamfer on the leading edges of the socket if there isn't one, using a file or grinding wheel.
2. Abrasive-blast the surface of the splines.
3. Clean parts with **Loctite® ODC-Free Cleaner & Degreaser**.
4. Apply **Loctite® 660™ Retaining Compound** to the shaft. Do not apply product into the socket.
5. Immediately push the spline/toothed shaft into the socket and remove excess adhesive.
6. Allow the adhesive to cure before returning to service.

RESULTS

- Restores assembly, so it is ready for service without a major overhaul
- Reduces scrap and costs by salvaging components
- Reduces downtime

CHALLENGE

Lubricate and protect sliding spline assemblies from unecessary fretting and wear

CAUSES:

- Wear will occur where there is friction and movement in the spline coupling
- Contamination between shaft and socket

SOLUTION

Apply Loctite® Moly Paste to splines during assembly to reduce friction

STEPS TO REPAIR:

1. Clean mating surfaces before application with **Loctite® ODC-Free Cleaner & Degreaser**.
2. Coat mating surfaces with **Loctite® Moly Paste**.
3. Assemble parts.

RESULTS

- Withstands extreme pressure and heavy loads
- Prevents wear caused by friction for long-lasting assemblies
- Prevents corrosion

Shaft Repair Product Application Table

APPLICATION	LOCTITE® SOLUTION	BENEFITS	SIZES	PART #	PG
Shaft Repair Solutions					
Repairing badly worn shaft	**Loctite® Fixmaster® Superior Metal**	Non-rusting, ferro-silicone-filled epoxy. Extremely high compressive strength and wear resistance. Sets in 20 minutes.	1 lb. Kit	**97473**	4
			4 kg Kit	**40900**	
Sleeving	**Loctite® 648™ Retaining Compound**	A retaining compound recommended for continuous working temperatures up to 350ºF (175ºC). Fills gaps up to 0.005" in diametral clearance. Fixtures in 5 minutes. Designed for press fits requiring high strength.	50 ml	**21444**	5
Securing Cylindrical and Taper Joints					
Press Fit – Mounting components to shaft	**Loctite® 648™ Retaining Compound**	A retaining compound recommended for continuous working temperatures up to 350ºF (175ºC). Fills gaps up to 0.005" in diametral clearance. Fixtures in 5 minutes. Designed for press fits requiring high strength.	50 ml	**21444**	6
	Loctite® 668™ Retaining Compound	Convenient semisolid formula. Withstands temperatures to 400ºF (204ºC). Ideal for gaps up to 0.005" in diameter.	19 g stick	**39148**	6
	Loctite® 609™ Retaining Compound	Low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	**60931**	6
Slip Fit – Mounting components to shaft	**Loctite® 620™ Retaining Compound**	High temperature resistance up to 450ºF. High viscosity securing cylindrical assemblies up to 0.015" diametral clearance.	50 ml	**62040**	6
	Loctite® 680™ Retaining Compound	A high strength retaining compound capable of filling diametral gaps up to 0.015". Allows for more relaxed machining tolerances.	50 ml	**68035**	6
Mount components requiring medium-to-large gap fill	**Loctite® 660™ Retaining Compound**	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	**66040**	6
Prevent bearing spinout, corrosion and component damage	**Loctite® 609™ Retaining Compound**	Low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	**60931**	7
	Loctite® 648™ Retaining Compound	A retaining compound recommended for continuous working temperatures up to 350ºF (175ºC). Fills gaps up to 0.005" in diametral clearance. Fixtures in 5 minutes. Designed for press fits requiring high strength.	50 ml	**21444**	7

APPLICATION	LOCTITE® SOLUTION	BENEFITS	SIZES	PART #	PG
Keyed Assemblies					
Prevent keyway wear	**Loctite® 243™ Threadlocker**	Anaerobic adhesive fills airspace, eliminating any micro-movement between the parts. Oil resistant, removable strength.	50 ml	**24078**	8
	Loctite® 248™ Threadlocker	Convenient semisolid anaerobic adhesive fills airspace, eliminating any micro-movement between the parts. Removable; medium strength.	19 g stick	**37087**	
Repair worn keyways	**Loctite® 660™ Retaining Compound**	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	**66040**	9
	Loctite® 648™ Retaining Compound	A retaining compound recommended for continuous working temperatures up to 350ºF (175ºC). Fills gaps up to 0.005" in diametral clearance. Fixtures in 5 minutes. Designed for press fits requiring high strength.	50 ml	**21444**	10
	Loctite® 243™ Threadlocker	Anaerobic adhesive fills airspace eliminating, any micro-movement between the parts. Oil resistant, removable strength.	50 ml	**24078**	11
	Loctite® Fixmaster® Superior Metal	Non-rusting, ferro-silicone-filled epoxy. Extremely high compressive strength and wear resistance. Sets in 20 minutes.	1 lb. kit	**97473**	
			4 kg kit	**40900**	
Spline Assemblies					
Securing fixed spline assemblies	**Loctite® 660™ Retaining Compound**	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	**66040**	12
Protect sliding spline assemblies from fretting and wear	**Loctite® Moly Paste**	Metal-free, general purpose lubricant. Lubricates and protects especially well during break-in and under high loads up to 750ºF (400ºC).	8 oz. brush-top can	**51048**	13
			1 lb. brush-top can	**51049**	
Cleaner and Primer					
Cleaning and degreasing prior to bonding	**Loctite® ODC-Free Cleaner & Degreaser**	Nonaqueous, hydrocarbon-based solvent for cleaning and degreasing surfaces to be bonded with adhesives, as well as any general purpose industrial cleaning.	15 oz. net wt. aerosol	**22355**	—
Priming components	**Loctite® 7649™ Primer**	Use with Loctite® retaining and threadlocking products to speed the cure on active metals or to ensure cure on inactive metals (stainless steel, aluminum, plated parts, etc.).	1.75 fl. oz. bottle	**38402**	—
			25 g net wt. aerosol can	**21347**	—

Additional Tools and Services

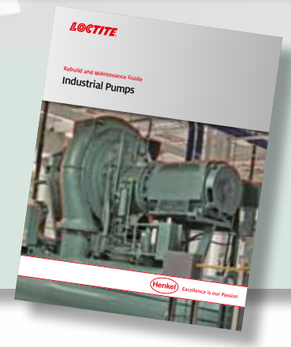
At Henkel Corporation, we invent more than just quality Loctite® brand products, we provide solutions to some of industry's biggest challenges. Whether looking to reduce costs, increase the reliability of equipment, or assist in product application, Henkel is dedicated to earning and keeping the trust of our customers.

Here are just a few Loctite tools and services you may be interested in:

Loctite Plant & Equipment Reliability for Manufacturers

Two hours of on-site training, reviewing common maintenance challenges and the appropriate Loctite® product solution customized to the needs of your plant.

Visit our website to learn more, download literature **LT-3690**, or contact your local Loctite Specialist to schedule a workshop.



Loctite Industrial Pump Rebuild and Maintenance Guide

This comprehensive guide details the assembly and repair steps that can be taken to increase efficiency and reduce or eliminate common failures with centrifugal pumps.

To get a copy of this guide, visit our website or call us at **1-800-LOCTITE** (562-8483) and reference literature **LT-4047**.

Loctite Industrial Gearbox Service Manual

This guide is designed to provide quick and easy assistance to professionals who service industrial gearboxes and look for reliability, longevity and cost reduction.

To get a copy of this guide, visit our website or call us at **1-800-LOCTITE** (562-8483) and reference literature **LT-4872**.